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Geology of the Eden Lake Area

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MAP

Map GR84-2 Geology of the Eden Lake area . . . . . in pocket

INTRODUCTION

LOCATION AND ACCESS

The Eden Lake area (map sheet 64C/9 of the National Topographic Series) is located 54 km southeast of Lynn Lake. It comprises approximately 840 km^2 between latitudes 56°30' and 56°45' north and longitudes 100° and 100°30' west. Access is provided by Provincial Road 391 which crosses the northeast corner of the area and lies within 3 km of the northern and eastern boundaries, permitting water access via Hughes River and the Churchill River at several locations.

Water access is generally very good. Eden Lake itself provides direct access to much of the central part of the area. Numakoos River, draining from the south end of Eden Lake, connects with Stag Lake and the Churchill River in the southwest. Rapids on this channel are easily navigable. Outlaw and Okowacheeweenik Bays, in the southeast, may be reached via the Churchill River near Leaf Rapids. Hughes River provides access to Wetikoeekan Lake and Pilote Lake in the north but rapids and waterfalls on the system permit only downstream navigation.

DRAINAGE AND TOPOGRAPHY

Eden Lake dominates the central part of the area, covering approximately 100 km^2. Hughes River flows south into Eden Lake through Wetikoeekan and Pilote Lakes near the northern boundary of the area. The system is linked through Adam Lake to Barrington River in the northeast, although flow between Eden and Adam Lakes is now minimal, being restricted to a road culvert. This forces most of the drainage south into the Churchill River.

Exposure on lakes and rivers is typified by small isolated outcrops separated by long stretches of heavily treed boulder shoreline. Inland outcrop is sparse. Most of the area is covered by mature northern boreal forest, consisting chiefly of black spruce with a few stands of mature birch. In 1981 forest fires swept through large areas along the western boundary.

A belt of glacial clays and sandy till covers most of the western third of the area producing large low-lying areas of swamp and muskeg locally broken by outcrop ridges. Sand deposits in the northeast are associated with a large esker that extends south to Leaf Rapids beyond the eastern boundary of the map sheet. Small boulder ridges and remnants of dissected eskers occur sporadically throughout the area.

High, bald hills and ridges of granite and pegmatitic granite are prominent in the east, rising to 60 m above the surrounding terrain. The arms of Outlaw Bay and Okowacheeweenik Bay, following strong 045° and 360° linear trends, are marked by shear cliffs up to 40 m high.

PREVIOUS WORK

The Eden Lake area was mapped at a scale of four miles to the inch by the Geological Survey of Canada as part of the Granville Lake sheet (east half) (Henderson et al., 1936). Reconnaissance of the shoreline of Eden Lake and exposures in the vicinity of Provincial Road 391 was carried out by Zwanzig (1974). McRitchie (1976) began preliminary mapping along the shoreline of Outlaw Bay. P.G. Lenton (1982) examined several phases of the monzogranites and granitic pegmatites along Provincial Road 391 and the shoreline of Eden Lake.

The Manitoba Geological Survey began mapping the adjoining areas in the 1940s and has maintained an ongoing program of revision and upgrading of the coverage. The Granville Lake sheet of the Bedrock Geology Compilation Map Series (Manitoba Energy and Mines, 1986) provides the most recent interpretation of the regional geology at a scale of 1:250 000.

PRESENT WORK

This report is based on 2.5 months of field work carried out during the summers of 1978 and 1979. Vertical aerial photographs at 1:31 680 (2 inches to 1 mile) were used to locate major areas of outcrop, and traverses were then carried out using standard pace and compass methods. In areas with few outcrops, exposures were verified from the air prior to traversing. Shoreline exposures on major lakes and rivers were investigated by boat. Helicopter and fixed wing aircraft were used to reach less accessible areas.

Geological field data were plotted on base maps, at a scale of 1:31 680, that were subsequently reduced to 1:50 000 for publication.

The author gratefully acknowledges the assistance in mapping provided by P.G. Lenton of Mineral Resources Division and field assistant A.J. Ross. Capable assistance in the field was also rendered by B. Lyons, D. Parbery, J.W. Pardy, T.M. Shklanka and K. Walko.

Following completion of field work approximately 500 stained samples were prepared for modal analysis. Point counts of 500 to 1000 points per slab were carried out by the author and junior assistant K. Murphy. Ternary diagrams were then prepared using the standard IUGS system for the classification and nomenclature of plutonic rocks (Streckeisen, 1973, 1975).

AVAILABLE MAPS AND AERIAL PHOTOGRAPHS

The Eden Lake area is covered at 1:250 000 by NTS Map 64C, Granville Lake. NTS Map 64C/9, Eden Lake, covers the area at 1:50 000. Both maps can be obtained from the Surveys Branch of the Manitoba Department of Natural Resources or from the Map Distribution Office in Ottawa.

Vertical aerial photographs at a scale of 1:31 680 are available from the National Airphoto Library in Ottawa. Rectified aerial photograph township mosaics at 1:31 680 are available from Surveys Branch.

Aeromagnetic Series map 2385G, produced by the Geological Survey of Canada, covers the map area at 1:63 360.

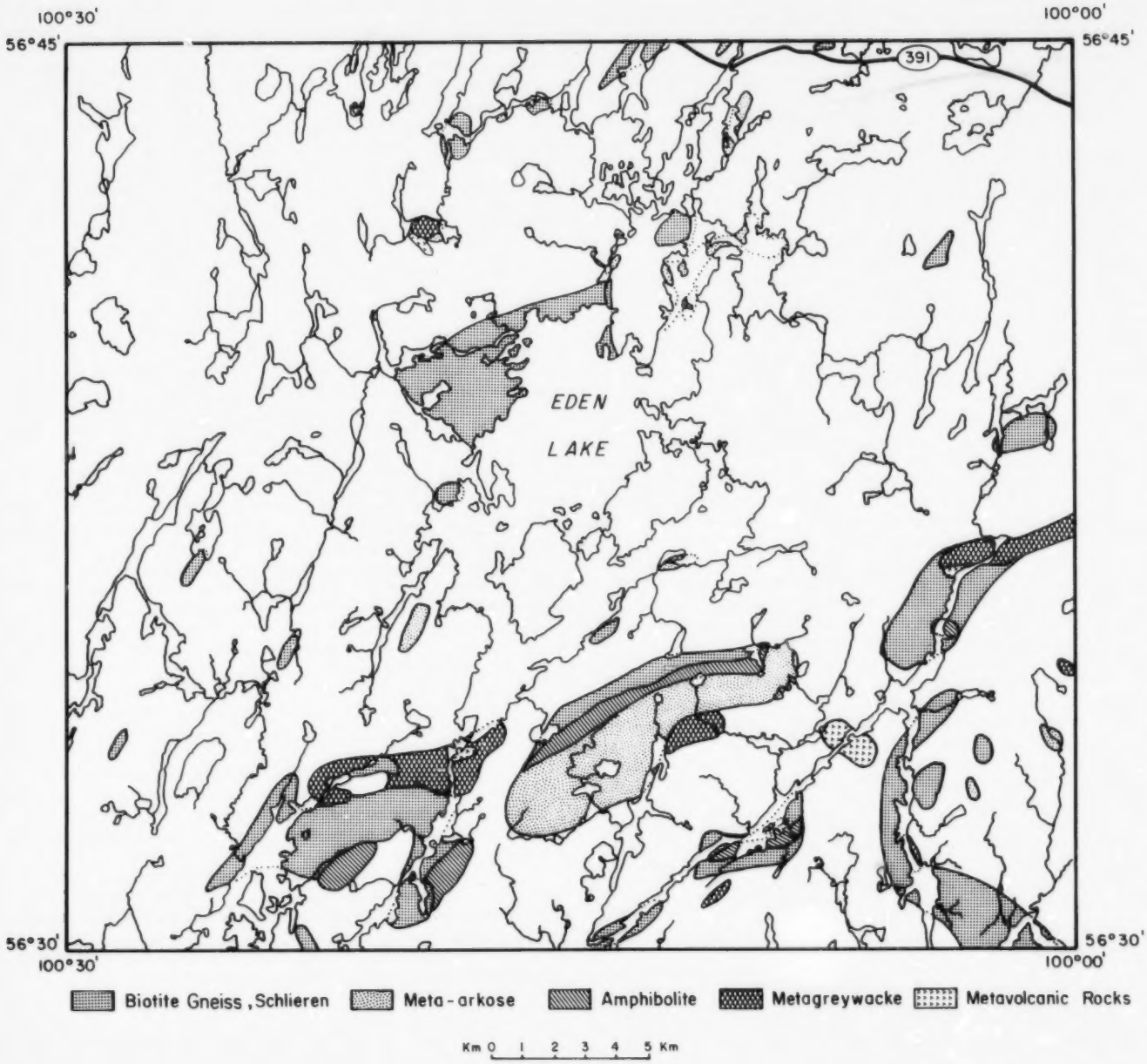


Figure 1: Distribution of rafts and inclusions of supracrustal rocks in the Eden Lake area.

GENERAL GEOLOGY

GEOLOGIC SETTING

The stratigraphy of the Eden Lake area is outlined in Table 1.

The Eden Lake area is underlain by an intrusive complex comprising older tonalite and quartz diorite intruded by granodiorite and granite. The more potassic phases form a small, zoned pluton in the northeastern part of the area. Potassium metasomatism has altered the adjacent tonalite to granodiorite for a distance of approximately 2 km. The textures and modal compositions of granite, megacrystic granodiorite and tonalite in the area bear a strong similarity to some phases of the Baldock batholith and Livingstone plutonic belt to the east (Lenton and Corkery, 1981).

Table 1
Table of Formations - Eden Lake Area

Pleistocene and Recent		Sand, gravel, clay and till deposits
		UNCONFORMITY
PRECAMBRIAN (EARLY PROTEROZOIC)	INTRUSIVE AND METAMORPHIC ROCKS	19 Pegmatite, pegmatitic granite, graphic granite, aplite
		18 Coarse grained monzogranite
		17 Fine grained biotite monzogranite, aplitic granite; (17a) fine grained, weakly porphyritic monzogranite
		16 Megacrystic monzogranite
		15 Muscovite granodiorite
		14 Fine- to medium-grained, weakly porphyritic granodiorite
		13 Fine grained, aegirine-augite-bearing monzonite
		12 Megacrystic granodiorite (to quartz monzodiorite)
		11 Seriate to megacrystic granodiorite; (11a) sheared, epidote-bearing megacrystic granodiorite; (11b) coarse grained, weakly porphyritic granodiorite
		10 Granodiorite to tonalite
		9 Granodiorite to granite
		8 Biotite granodiorite ± hornblende; (8a) porphyroblastic granodiorite
		7 Biotite tonalite ± hornblende; (7a) porphyroblastic tonalite
		6 Coarse grained to megacrystic quartz diorite; (6a) megacrystic quartz monzodiorite
		5 Quartz monzodiorite, highly tectonized
		4 Diorite, gabbro; (4a) feldspar cumulophyric metagabbro; (4b) coarse grained gabbro, ultramafic rock; (4c) quartz diorite
		INTRUSIVE CONTACT
	METASEDIMENTARY AND METAVOLCANIC ROCKS OF UNCERTAIN AGE	3 Paragneiss of unknown affinity, grey biotite gneiss, schlieren (subordinate lithology not occurring as map unit.)
		2 Metasedimentary rocks; (2a) psammitic metagreywacke ± garnet; (2b) amphibolite, fine grained, layered; (2c) iron formation; (2d) arkosic gneiss ± hornblende ± magnetite
		1 Metavolcanic rocks; (1a) mafic volcanic rocks, basalt flows and flow breccia; (1b) felsic volcanic rocks, dacite, dacitic tuff

The area is flanked by the Lynn Lake greenstone belt to the north, the Rusty Lake greenstone belt to the east and the Kisseynew metasedimentary gneiss belt to the south and west, lying within the western part of the Leaf Rapids domain (Zwanzig et al., 1985).

Supracrustal rocks occur only as rafts and discontinuous screens in the intrusive phases. Weak aeromagnetic highs of 2700 to 3000 gammas outline a zone of metasedimentary inclusions south of Eden Lake. Aeromagnetic readings of up to 3200 gammas are associated with inclusions of metavolcanic rocks in megacrystic granodiorite in the north-central part of the area.

In general, the intrusive rocks have broad, weak magnetic signatures. The younger granites and granodiorites generally show responses above 2700 gammas whereas those of the older tonalitic phases are lower.

The Johnson Shear zone lies within 2 km of the northern boundary, extending from Cartwright Lake to Barrington River. At several locations along the northern edge of the area the rocks have been highly tectonized. Tonalite and granodiorite in the northwest corner of the area, south of Westdahl Lake, are mylonitic. Local zones of shearing and recrystallization occur in tonalite and granodiorite in the western part of the area. Shear and concomitant recrystallization in the Outlaw Bay-Okowacheeweenik Bay area have affected monzodiorite xenoliths that occur in unsheared tonalite and granodiorite along the arms of the bays.

SUPRACRUSTAL ROCKS

There are no large, continuous occurrences of supracrustal rock in the map area. Rafts and discontinuous screens are found in most of the intrusive phases but few are mappable units (Fig. 1). Most primary supracrustal features have been destroyed, leaving only schlieren and small lenticular xenoliths of fine grained amphibolite and biotite gneiss. Metavolcanic rocks are identifiable at several locations but exposure is too sporadic to establish any sense of continuity or stratigraphic relations.

A broad train of metasedimentary rafts can be traced across the area from the eastern boundary to Stag Lake. A consistent stratigraphy can be established with magnetite-bearing meta-arkose (2d) rafts farthest south, grading into amphibolite (2b). The amphibolite inclusions then grade into grey biotite gneiss (3) and psammitic metagreywacke (2a). This belt of mixed inclusions in tonalite (7) is similar to the Opachuanau gneisses to the east (Steeves and Lamb, 1972; Zwanzig, 1974).

METAVOLCANIC ROCKS

A narrow, steeply dipping screen of metavolcanic rock extends into the map area from beyond the northern boundary at Wetikoeekan Lake. Sheared mafic to intermediate flows and flow breccia (1a) are interlayered with laminated quartz-epidote rock and light grey dacitic tuffs (1b). The mafic flows contain 1 to 8 mm amygdales in a fine grained basaltic groundmass. The quartz-epidote rock is well layered and contains 2 to 10 cm calc-silicate boudins and 1 to 4 mm hornblende phenocrysts. Veins of tonalite (7) and megacrystic granodiorite (12) intrude the metavolcanic rocks. Total thickness of the screen is approximately 10 m.

South of Pilote Lake a small cluster of supracrustal rafts occurs in megacrystic granodiorite. Inclusions of basalt flows and flow breccia are mixed with mafic crystal tuff, layered iron formation (2c), quartz-rich psammitic greywacke (2a) and hornblende arkose (2d). Exposure of all but the granodiorite is too poor to determine the extent and field relations of the inclusions.

METASEDIMENTARY ROCKS

PSAMMITIC METAGREYWACKE (2a)

Inclusions of fine grained, grey, psammitic gneiss are common in tonalite (7) and are frequently associated with xenoliths of older tonalite and diorite (4, 5 and 6). The average composition of the metagreywacke restite is 60% plagioclase, 10% quartz and 25% biotite. In most exposures it is garnet-free and locally may contain magnetite and hornblende with trace amounts of muscovite, epidote and diopside.

On several small outcrops at the northeast end of Stag Lake fine grained greywacke metatexite containing 2 to 4 mm garnet and cordierite occurs with layered amphibolite (2b).

AMPHIBOLITE (2b)

Fine grained, layered amphibolite rafts are found in tonalite (7), granodiorite (8) and the early intrusive phases (5 and 6). The amphibolite is made up of 5 to 10 cm mafic layers separated by 1 to 5 cm calc-silicate-bearing leucocratic layers and white tonalitic veins and *lits*. Locally the amphibolite is associated with pods of coarse grained melagabbro (4b). In areas where the amphibolite has undergone a higher degree of assimilation by younger intrusions it is more massive and lacks visible layering.

IRON FORMATION (2c)

Two outcrops of layered iron formation occur in the area of megacrystic granodiorite (12) south of Pilote Lake. The rock is black to rusty brown weathering with fine 1 to 3 mm quartz laminae and contains disseminated pyrite, pyrrhotite, magnetite and hematite. No other occurrences were noted in the area.

ARKOSIC GNEISS (2d)

Quartzofeldspathic gneiss, interpreted as meta-arkose is found throughout the central part of the map area ranging from well preserved and delicately layered to digested inclusions and schlieren. Light grey, quartz-rich restite layers 3 mm to 20 cm thick are separated by 5 mm to 10 cm pink granitic *lits*.

The average compositional range of the gneiss is 40 to 50% quartz, 20 to 30% plagioclase, 15 to 20% microcline and perthite and 20% biotite. Magnetite is common and is associated with trace amounts of pyrite and hematite. Hornblende, epidote and traces of muscovite and allanite occur locally.

PARAGNEISS OF UNKNOWN AFFINITY, GREY BIOTITE GNEISS (3)

Small rafts of fine grained light to dark grey biotite gneiss, locally hornblende-bearing, with white tonalitic *lits* are common throughout the map area.

The inclusions occur as small sandy textured ovoid xenoliths and nebulitic blocks, in tonalite (7) and granodiorite (8) as well in as many of the younger phases. Their small size and the degree of assimilation by the host rock leaves little to indicate their origin or their relationship to other supracrustal rocks. It is most likely that the gneiss has been derived from a psammitic metasandstone (2a) and amphibolite (2b).

INTRUSIVE ROCKS

The intrusive rocks in the Eden Lake area show a history of multiple phases of intrusions, assimilation of older phases and later metasomatism resulting in a complex mixing of major and minor phases. In general, unit boundaries are not exposed and many contacts are gradational.

For descriptive purposes the major intrusive phases can be grouped into five suites of units having similar ages and compositions (Fig. 2). These show a general evolution over time from quartz diorite and gabbro to tonalite granodiorite and granite.

The oldest suite comprises units 4, 5 and 6, ranging in composition from diorite and gabbro to quartz monzodiorite and in size from small xenoliths several centimetres across to large inclusions of up to 10 km2. These units are strongly foliated and hornblende-bearing and show the greatest degree of crushing and alteration of feldspars found in close association with digested supracrustal rafts and schlieren.

The Outlaw Bay suite, comprising biotite tonalite (unit 7) and biotite granodiorite (unit 8), dominates the southern half of the map area and have a very restricted compositional range. The contact between the tonalite and granodiorite is gradational with potassium feldspar content increasing to the north.

The third suite, coarse grained to megacrystic granodiorite (9, 10, 11, 12, 14 and 15), intrudes tonalite (7). These granodiorites fall into several compositional fields and can vary widely in texture. Contacts betweens units 11 and 12 are gradational and these phases are assumed to be comagmatic.

Aegirine-augite monzonite (13) occurs as a discrete body east of Eden Lake and as rafts in younger monzogranites. It is intruded by fluorite- and andradite-bearing pegmatite dykes.

The Eden monzogranite suite (16, 17 and 18) forms a zoned body in the northeastern quadrant of the area. The granites have similar compositions and range from aplitic to megacrystic. Pegmatite and pegmatitic granite (19) are associated with these later phases.

Early Quartz Diorite Suite

QUARTZ DIORITE, GABBRO (4)

Unit 4 represents the earliest intrusive phase, preserved only as xenoliths and large rafts in the later units. Feldspar cumulophyric gabbro (4a) is found at several locations in the Outlaw Bay area and is associated with inclusions of supracrustal material in the tonalite (7) and granodiorite (11a). The gabbro consists of a fine- to medium-grained hornblende, plagioclase, biotite groundmass with prominent white to pink feldspar laths and clotted masses up to 2.5 cm across.

Coarse grained gabbro (4b) occurs sporadically as large pods several metres in length in granodiorite to tonalite (10), granodiorite (11) and tonalite (7). The metagabbro is massive, comprising coarse, felted amphibole to 1 cm, highly altered plagioclase and biotite. It commonly occurs with quartz diorite (6) and amphibolite (2b).

Medium grained quartz diorite (4c) occurs as mesocratic inclusions in megacrystic quartz monzodiorite (6a) and biotite monzogranite (18) near Provincial Road 391, north of Eden Lake. The quartz diorite contains some schlieren and is cut by veins of unit 18. It appears to have been rafted originally by the quartz monzodiorite which was subsequently intruded by the monzogranite.

QUARTZ MONZONITE, MONZODIORITE (5)

Quartz monzonite (Fig. 3, Table 2) occurs in the Outlaw Bay area as highly recrystallized xenoliths within tonalite (7) and granodiorite (11). The quartz monzonite has a sugary texture and is buff to pink with distinctive 4 mm to 2 cm biotite-hornblende clots. In some exposures 1.5 cm quartz-feldspar augen have developed. The crushed and granulated groundmass comprises sericitized and saussuritized feldspars and granulated quartz. Hornblende is poikiloblastic and is associated with large sphene grains and retrograde biotite. Schlieren and digested inclusions of supracrustal rock occur frequently with unit 5. Rafts of the quartz monzonite range from rounded, 40 cm, randomly oriented pods to large inclusions covering several square kilometres.

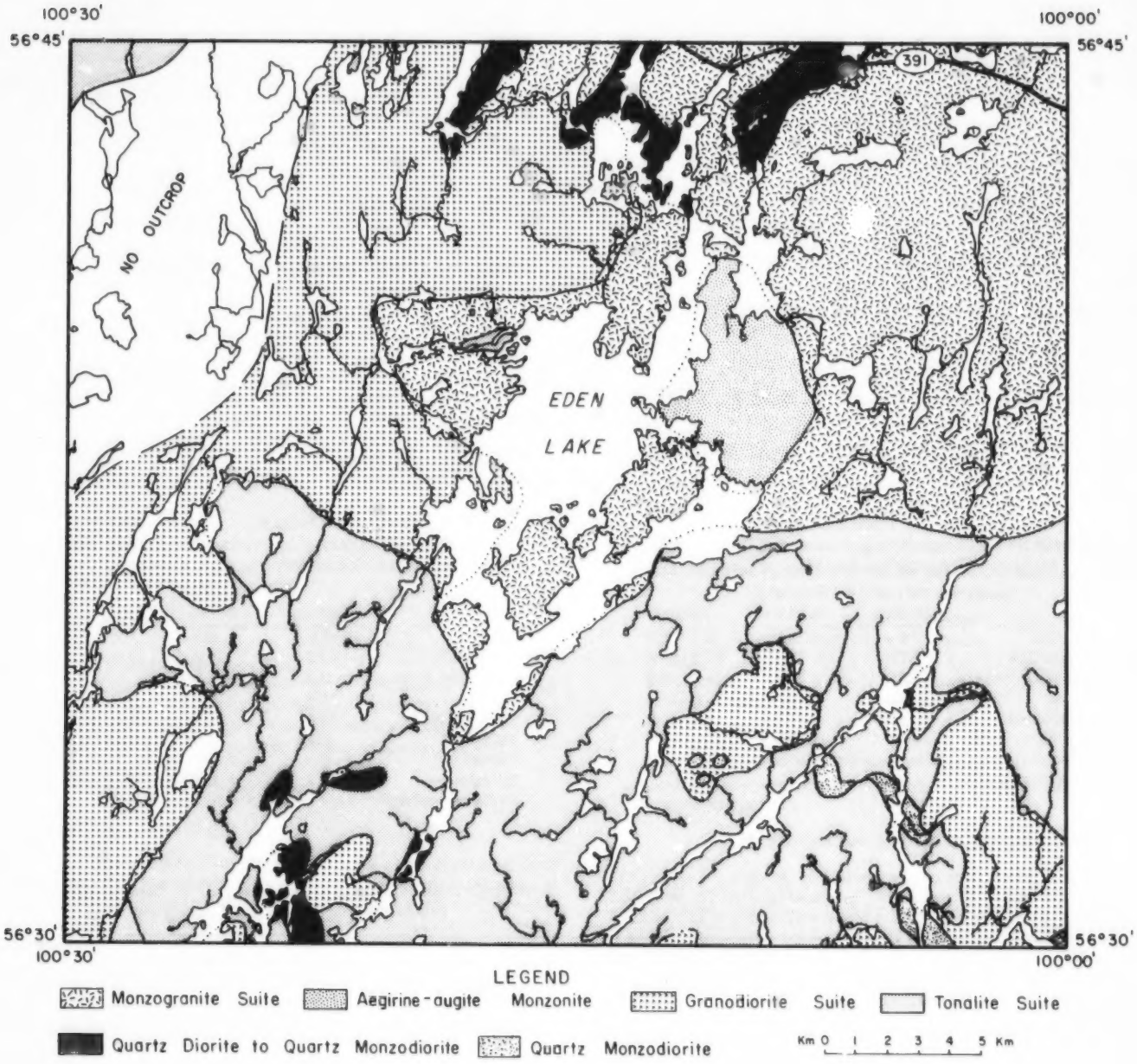


Figure 2: Major intrusive phases in the Eden Lake area.

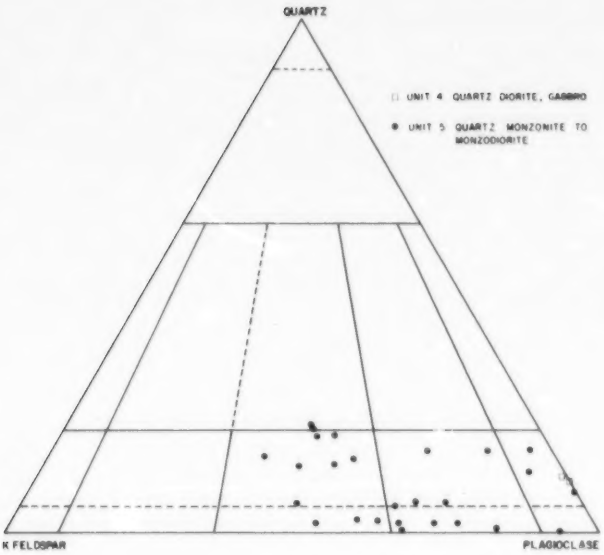


Figure 3: Modal compositions of quartz diorite (4) and quartz monzodiorite (5).

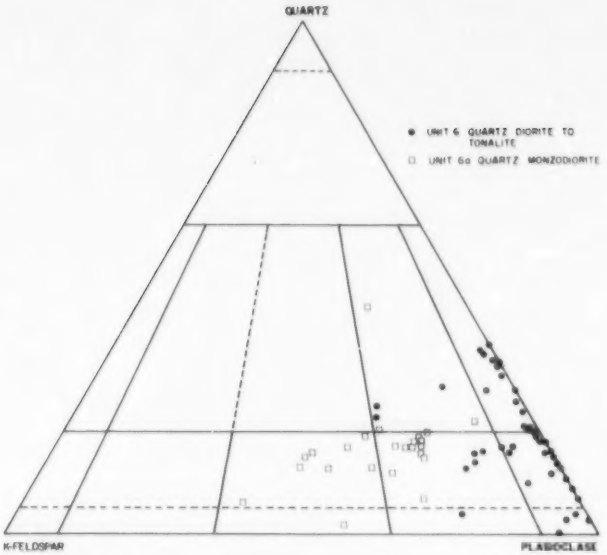


Figure 4: Modal compositions of quartz diorite to tonalite (6) and quartz monzodiorite (unit 6a).

Table 2
Average Modal Composition in Volume Per Cent of Quartz Monzodiorite (5); Outlaw Bay Area (19 samples)

	Average	Standard Deviation	Range
Quartz	6.4	± 5.0	0.4 - 15.0
Plagioclase	53.8	± 11.3	31.2 - 73.4
Potassium feldspar	22.6	± 14.1	trace - 44.0
Biotite	5.0	± 3.6	0 - 11.2
Hornblende	11.6	± 12.3	0 - 51.0
Magnetite	0.4	± 0.7	0 - 2.4

Epidote, sphene, apatite, metamict allanite and pyrite in trace amounts

Table 3
Average Modal Composition in Volume Per Cent of Quartz Diorite (6); Hughes River Area (9 samples)

	Average	Standard Deviation	Range
Quartz	15.9	± 5.7	8.0 - 28.0
Plagioclase	53.6	± 11.6	35.4 - 72.2
Potassium feldspar	3.3	± 2.5	0.3 - 5.8
Biotite	15.8	± 8.3	3.0 - 25.0
Hornblende	13.4	± 11.5	0.2 - 33.0
Magnetite	0.2	± 0.2	0 - 0.6
Hematite	0.1	± 0.3	0 - 0.8
Epidote	0.2	± 0.7	0 - 2.0

Pyrite and sphene in trace amounts with magnetite

Table 4
Average Modal Composition in Volume Per Cent of Quartz Diorite (6); Stag Lake Area (13 samples)

	Average	Standard Deviation	Range
Quartz	14.9	± 6.6	3.0 - 24.6
Plagioclase	59.3	± 10.9	40.0 - 82.4
Potassium feldspar	1.2	± 3.4	0 - 12.6
Biotite	8.6	± 7.3	0 - 25.4
Hornblende	14.3	± 11.0	0 - 36.0
Magnetite	0.6	± 1.2	0 - 4.4

Epidote and sphene in trace amounts

QUARTZ DIORITE, QUARTZ MONZODIORITE (6)

Several bodies of quartz diorite (Fig. 4), covering areas of up to 12 km^2, occur in tonalite (7), granodiorite (12, 14) and monzogranite (18) in the northern part of the map area and at Stag Lake. Unit 6 is coarse grained with a rough, pitted surface texture due to weathering out of 2 mm to 1 cm biotite-hornblende aggregates. White, subhedral to lenticular plagioclase megacrysts up to 3 cm, irregular patches of rusty weathering and a network of resistant white aplitic veins are prominent on the outcrop surface. The groundmass comprises crushed plagioclase and quartz. Retrograde biotite partially replaces hornblende. The quartz diorite contains up to 20% quartz, 50% heavily sericitized plagioclase, less than 1% potassium feldspar, 10 to 30% hornblende, 5 to 10% biotite, up to 5% epidote and 0.2 to 1.4% magnetite. Trace amounts of pyrite, hematite, allanite, sphene and apatite also occur (Tables 3, 4 and 5).

Most exposures contain schlieren and partially assimilated rafts of biotite gneiss and amphibolite.

At Pilote Lake rafts of unit 6 are found in seriate porphyritic granodiorite (11) which occurs as inclusions in megacrystic granodiorite (12).

Adjacent to the late monzogranites (16, 17 and 18) potassium metasomatism has altered the quartz diorite to quartz monzodiorite (6a). The rock comprises zoned 1.5 to 3 cm potassium feldspar porphyroblasts and 1 cm sericitized plagioclase megacrysts in a

Table 5
Average Modal Composition in Volume Per Cent of Quartz Diorite (6); Outlaw Bay Area (5 samples)

	Average	Standard Deviation	Range
Quartz	9.5	± 5.7	2.2 - 16.2
Plagioclase	71.8	± 9.5	57.2 - 83.8
Potassium feldspar	0.1	± 0.2	0 - 0.4
Biotite	9.9	± 1.4	8.0 - 11.8
Hornblende	7.8	± 7.8	0.4 - 19.6
Magnetite	0.8	± 1.5	0 - 3.4

Table 6
Average Modal Composition in Volume Per Cent of Quartz Monzodiorite (6a); Hughes River Area (19 samples)

	Average	Standard Deviation	Range
Quartz	15.0	± 7.2	5.4 - 40.6
Plagioclase	48.3	± 7.5	33.0 - 59.?
Potassium feldspar	22.5	± 10.8	8.0 - 53.8
Biotite	8.1	± 6.7	0 - 19.6
Hornblende	5.4	± 7.0	0 - 27.0
Magnetite	0.3	± 0.4	0 - 1.6

Epidote, sphene, hematite, pyrite and apatite in trace amounts

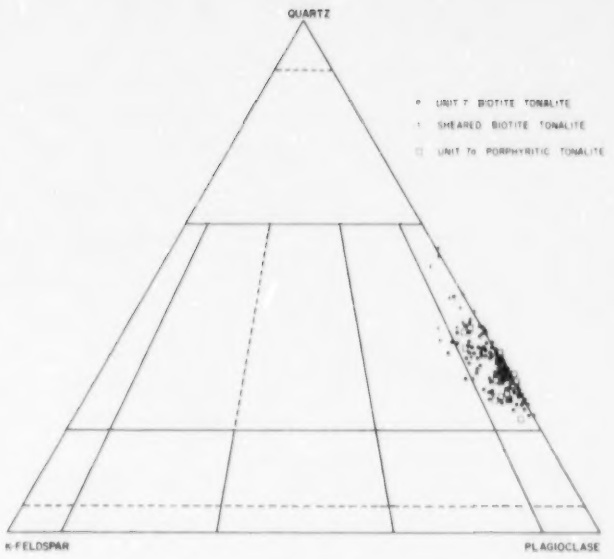


Figure 5: Modal compositions of biotite tonalite (7).

medium grained granular groundmass of crushed quartz and plagioclase, hornblende and biotite. Plagioclase grain boundaries are corroded by the late microcline. Unit 6a ranges from massive to gneissic and contains schlieren and xenoliths of units 3 and 4c. Rafts of quartz monzodiorite occur in monzogranite (18) near the contact and veins of unit 18 intrude unit 6a.

Composition ranges from 10 to 15% quartz, 30 to 45% plagioclase, 10 to 20% potassium feldspar, 10 to 20% biotite and 3 to 10% hornblende. Accessory minerals include magnetite, to 2%; epidote, to 0.4%; sphene, to 0.2%; pyrite; and apatite (Table 6).

Biotite Tonalite And Granodiorite Suite

BIOTITE TONALITE (7)

Biotite tonalite (Fig. 5) underlies most of the southern half of the map area. The tonalite is medium- to coarse-grained and white to grey weathering with some hematite staining on joints and fractures. Unit 7 has a very narrow compositional range, averaging 30% quartz, 60% plagioclase, less than 2% potassium feldspar and 10% total mafic minerals. Common accessory minerals are magnetite, to 0.4%; epidote, less than 2%; and muscovite, less than 0.6%; trace amounts of pyrite, sphene, allanite and hematite are present(Table 7). Garnet occurs only in the vicinity of metagreywacke inclusions (2a).

The tonalite is homogeneous and equigranular to weakly porphyritic with plagioclase phenocrysts ranging from 5 mm to 1 cm and fine interstitial potassium feldspar. The rock is massive to weakly foliated and locally sheared. Tonalite and granodiorite in the vicinity of the Johnson Shear are mylonitic. Xenoliths of sugary, white recrystallized tonalite, having a slightly higher quartz content occur in small shear zones in unit 7 and granodiorite (11b) near Lafontaine Lake and Spearin Lake, west of Eden Lake.

The northern margin of the biotite tonalite has been intruded by veins of monzogranite (18), granodiorite (11), and pegmatite and

Table 7
Average Modal Composition in Volume Per Cent of Biotite Tonalite (7); Eden Lake Area (107 samples)

	Average	Standard Deviation	Range
Quartz	29.4	± 6.9	15.2 - 50.7
Plagioclase	56.6	± 6.6	28.4 - 73.2
Potassium feldspar	2.2	± 2.2	0 - 7.6
Biotite	7.9	± 5.9	0 - 24.8
Hornblende	3.6	± 5.3	0 - 20.2
Magnetite	0.2	± 0.3	0 - 1.6

Epidote, sphene, diopside, muscovite, carbonate and apatite in trace amounts

aplite (19). Rafts of unit 7 are found within the chain of pegmatitic granite bodies (Fig. 6) south and east of Eden Lake. Inclusions of supracrustal rocks (1, 2 and 3) and the older tonalite and diorite suite (4, 5 and 6) are common throughout unit 7.

Porphyroblastic tonalite (7a) is exposed at the intersection of Outlaw Bay and Okowacheeweenik Bay. The rock is grey, well foliated and coarse grained with plagioclase phenocrysts to 1 cm, and scattered 1.5 cm potassium feldspar porphyroblasts. The porphyroblastic tonalite is cut by veins of granodiorite (11a), pegmatite and aplitic granite and contains inclusions of amphibolite (2b), biotite gneiss (3), quartz diorite (4c), metagabbro (4a) and quartz monzonite (5). Xenoliths of the porphyroblastic phase occur within the surrounding tonalite (7).

Typical composition of unit 7a is 25% quartz, 55% plagioclase and 2% potassium feldspar. Biotite content ranges up to 15%, hornblende to 4% (increasing to 15% in the vicinity of mafic rafts) and magnetite to 0.4% (Table 8).

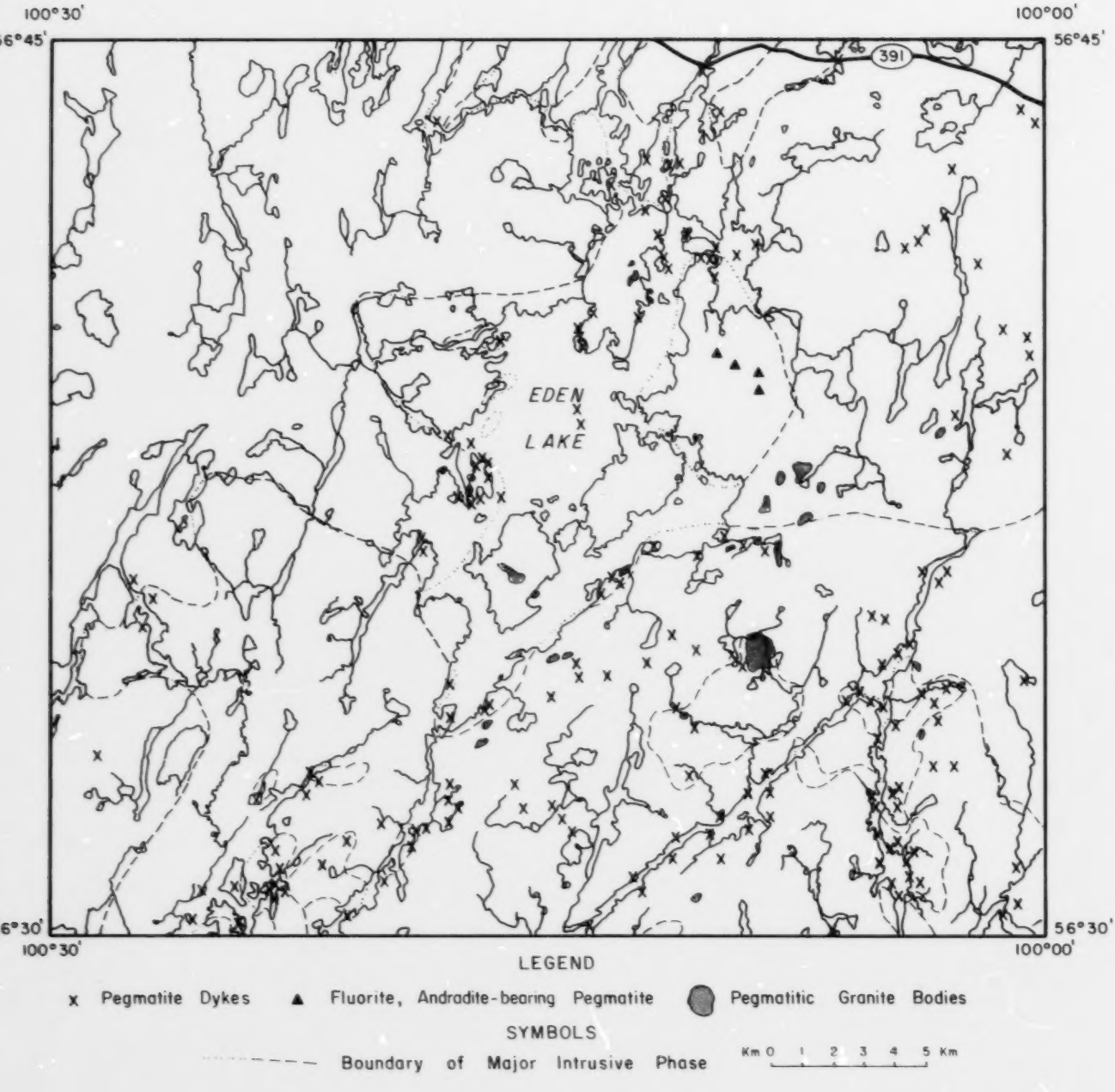


Figure 6: Distribution of pegmatite and pegmatitic granite in the Eden Lake area.

Table 8

Average Modal Composition in Volume Per Cent of Porphyroblastic Tonalite (7a); Outlaw Bay Area (9 samples)

	Average	Standard Deviation	Range
Quartz	25.3	± 4.5	18.6 - 33.4
Plagioclase	51.8	± 4.0	46.4 - 58.2
Potassium feldspar	2.7	± 2.3	0.2 - 7.4
Biotite	14.1	± 5.2	5.4 - 22.8
Hornblende	5.7	± 4.8	0 - 10.5
Magnetite	0.2	± 0.4	0 - 0.4
Epidote	0.2	± 0.7	0 - 2.0

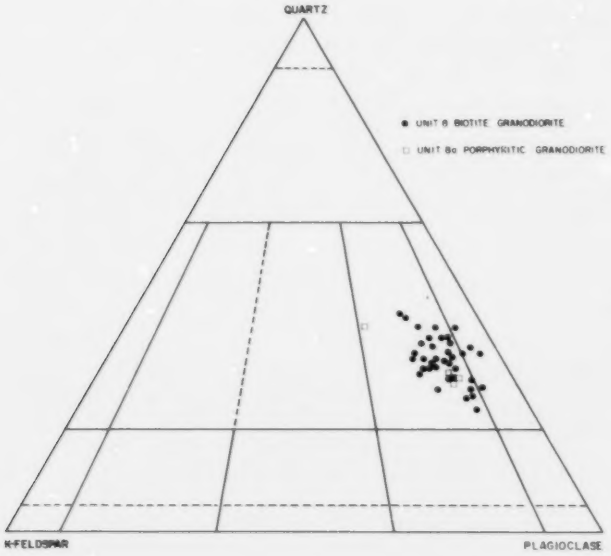


Figure 7: Modal compositions of biotite granodiorite (8).

BIOTITE GRANODIORITE (8)

Biotite granodiorite (Fig. 7) occurs in a zone approximately 2 km wide, between biotite tonalite (7) and the younger monzogranites in the northeast. The granodiorite is similar to unit 7 but contains 5 mm feldspar porphyroblasts presumed to be due to potassium enrichment by the adjacent granite. Quartz content averages 30%; plagioclase, 45 to 50%; microcline and perthite, 5 to 15%; biotite, 5 to 10%; magnetite, up to 2% and epidote, to 0.5%, with trace amounts of muscovite, sphene and hematite (Table 9).

Unit 8 is medium- to coarse-grained, massive to weakly foliated and white to buff-pink.

Veins and dykes of seriate porphyritic granodiorite (11), fine grained granodiorite (14), monzogranite (18), pegmatite and aplite intrude the biotite granodiorite. As with unit 7, the biotite granodiorite contains rafts of supracrustal rocks (1 to 3) and older intrusive phases (4 to 6).

East of Outlaw Bay and Okowacheeweenik Bay, a coarsely porphyroblastic phase (unit 8a) contains subhedral plagioclase megacrysts to 2 cm and potassium feldspar porphyroblasts to 1 cm. Overall composition is essentially the same as typical unit 8. Unit 8a contains rafts of units 1b, 2a, b and c and tonalite (7) and is intruded by pegmatite dykes (Table 10).

Table 9

Average Modal Composition in Volume Per Cent of Biotite Granodiorite (8); Edon Lake Area (30 samples)

	Average	Standard Deviation	Range
Quartz	32.4	± 4.7	26.0 - 42.0
Plagioclase	51.7	± 6.0	38.6 - 63.2
Potassium feldspar	10.3	± 3.7	4.0 - 20.0
Biotite	2.9	± 2.8	0 - 10.4
Hornblende	1.9	± 2.6	0 - 7.0
Magnetite	0.3	± 0.3	0 - 1.0

Epidote, sphene, apatite, muscovite, chlorite, and metamict allanite in trace amounts

Table 10

Average Modal Composition in Volume Per Cent of Porphyroblastic Granodiorite (8a) ; Okowacheeweenik Bay (4 samples)

	Average	Standard Deviation	Range
Quartz	27.2	± 4.2	22.0 - 31.6
Plagioclase	56.5	± 5.0	51.3 - 58.6
Potassium feldspar	8.1	± 0.6	7.4 - 8.8
Biotite	6.3	± 1.0	5.2 - 7.4
Hornblende	1.8	± 1.1	0.8 - 3.4
Magnetite	0.3	± 0.4	0 - 0.8

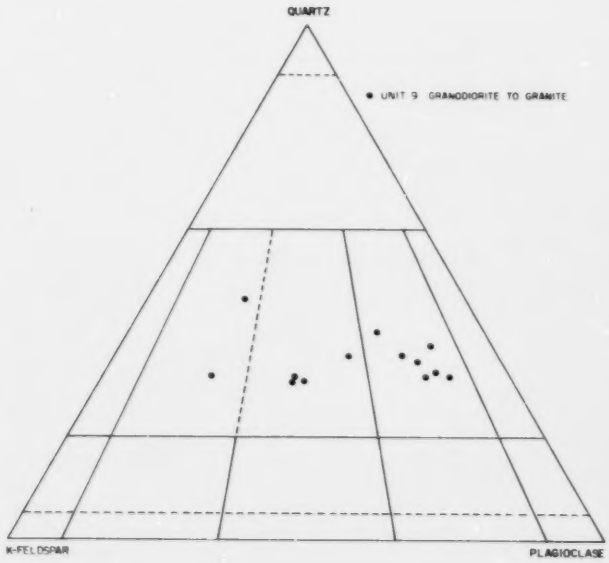


Figure 8: Modal compositions of granodiorite to granite (9).

Granodiorite Suite

GRANODIORITE TO GRANITE (9)

Several small bodies of biotite granodiorite and monzogranite, covering areas of 1 to 3 km^2, intrude tonalite (7) south of Outlaw Bay and at Stag Lake (Fig. 8). Unit 9 is pink weathering and coarse

Table 11
Average Modal Composition in Volume Per Cent of Granodiorite to Granite (9); Numakoos River Area (14 samples)

	Average	Standard Deviation	Range
Quartz	32.9	± 3.3	28.4 - 39.8
Plagioclase	43.7	± 8.1	31.4 - 52.2
Potassium feldspar	19.7	± 10.5	9.2 - 24.6
Biotite	3.4	± 2.9	0.4 - 10.6
Hornblende	0	± 0.1	0 - 0.4
Magnetite	0.3	± 0.2	0 - 0.6

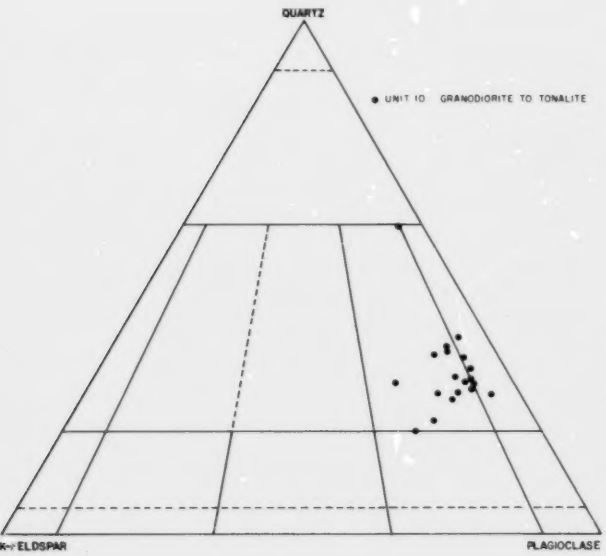


Figure 9: Modal compositions of granodiorite to tonalite (10).

grained to weakly porphyroblastic with perthitic feldspar porphyroblasts of 1 to 1.5 cm. Typical modal composition is 30% quartz, 30 to 50% plagioclase, 15 to 25% potassium feldspar, 4% biotite and 0.4% magnetite, with trace amounts of epidote, sphene, muscovite, hematite and pyrite (Table 11). Potassium feldspar content is elevated in the surrounding tonalite and veins of unit 9 intrude unit 7 and quartz diorite (6) at Stag Lake.

The biotite granodiorite to granite contains inclusions of units 3, 6 and 7 and is intruded by veins of aplite and pegmatite.

GRANODIORITE TO TONALITE (10)

East of Outlaw Bay and at Lafontaine Lake medium- to coarse-grained granodiorite to tonalite intrudes unit 7 (Fig. 9). The grey to pink granodiorite is massive to well foliated and contains 4 mm to 1 cm potassium feldspar porphyroblasts and zoned, sericitized plagioclase.

Unit 10 contains rafts of fine grained amphibolite (2b), coarse grained gabbro (4b) and coarse grained quartz diorite (6) as well as schlieren. The rock is intruded by veins of megacrystic granodiorite (11 and 11b), graphic granite, pegmatite and aplite.

Table 12
Average Modal Composition in Volume Per Cent of Granodiorite to Tonalite (10); Okowacheeweenik Bay Area (16 samples)

	Average	Standard Deviation	Range
Quartz	29.5	± 6.8	18.6 - 42.4
Plagioclase	50.1	± 8.3	39.2 - 65.6
Potassium feldspar	12.5	± 6.3	4.6 - 26.2
Biotite	5.5	± 3.3	0.8 - 12.4
Hornblende	1.8	± 3.5	0 - 11.0
Magnetite	0.4	± 0.4	0 - 1.6

Table 13
Average Modal Composition in Volume Per Cent of Granodiorite to Tonalite (10); Lafontaine Lake Area (5 samples)

	Average	Standard Deviation	Range
Quartz	29.8	± 3.9	24.2 - 34.8
Plagioclase	56.4	± 4.8	50.2 - 61.8
Potassium feldspar	7.9	± 3.02	4.4 - 11.8
Biotite	5.2	± 2.2	1.8 - 7.4
Hornblende	0.3	± 0.4	0 - 0.8
Magnetite	0.4	± 0.5	0 - 1.2

Composition of unit 10 is 25 to 35% quartz, 45 to 55% plagioclase, 5 to 15% potassium feldspar, and 5% biotite and chlorite. Up to 10% hornblende and 1.5% magnetite may occur and epidote, sphene, apatite, muscovite and hematite are present in trace amounts (Tables 12 and 13).

SERIATE TO MEGACRYSTIC GRANODIORITE (11)

A large body of coarse grained leucocratic granodiorite covers approximately 150 km^2 in the western part of the area, extending from the southwest corner of the map sheet to the west shore of Eden Lake and north to Wetikoeekan Lake. Three smaller intrusions of similar texture and composition are exposed at Ministik Lake and Outlaw Bay (Fig. 10).

In the north, unit 11 has a seriate texture with perthitic feldspar phenocrysts ranging from 2 mm to 1 cm and variable amounts of well formed megacrysts to 2 cm. The rock is light grey to pink and is massive.

Typical samples contain 25 to 35% quartz, 35 to 45% plagioclase and 20 to 25% perthitic microcline. Biotite ranges from 0 to 15%, hornblende to 8% and magnetite to 0.6% with traces of muscovite and epidote (Tables 14, 15 and 16). The perthitic megacrysts contain remnant plagioclase. Plagioclase is crushed and altered to sericite.

Unit 11 contains rafts of tonalite (7 and 10), amphibolite (2b), biotite gneiss (3) and schlieren. The granodiorite at Ministik Lake contains large inclusions of highly tectonized quartz monzodiorite (5). Veins of unit 11 intrude units 7 and 10 and rafts of the granodiorite are found in megacrystic monzogranite (16).

A sheared, epidote-bearing phase (11a), containing 2 cm feldspar augen, occurs south of Wetikoeekan Lake, separating units 11 and 12, and at the intersection of the arms of Outlaw and Okowacheeweenik Bays. The rock has a strong cataclastic foliation and contains sericitized plagioclase, clots of intergrown biotite and hornblende, epidote, allanite, sphene, and apatite. At Outlaw Bay unit 11a contains rafts of porphyroblastic tonalite (7a) (Tables 17 and 18). Unit 11b, in the southwest, is coarse grained and weakly porphyritic with perthitic microcline to 1 cm. Plagioclase is crushed and granu-

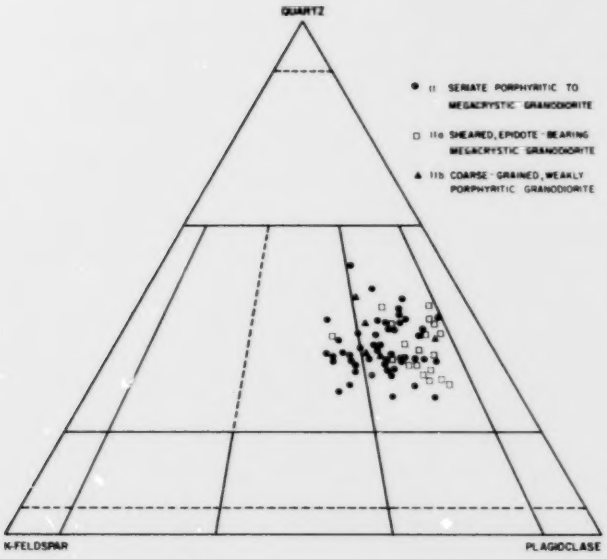


Figure 10:Modal compositions of megacrystic granodiorite (11).

Table 14

Average Modal Composition in Volume Per Cent of Seriate to Megacrystic Granodiorite (11); Wetikoseskan Lake-Muskose Bay Area (13 samples)

	Average	Standard Deviation	Range
Quartz	35.7	± 5.8	26.6 - 47.8
Plagioclase	42.3	± 3.8	37.0 - 51.6
Potassium feldspar	15.0	± 4.7	9.4 - 26.0
Biotite	4.1	± 5.1	0 - 15.4
Hornblende	2.4	± 2.6	0 - 7.6
Magnetite	0.3	± 0.2	0 - 0.6

Epidote and sphene in trace amounts

Table 15

Average Modal Composition in Volume Per Cent of Seriate to Megacrystic Granodiorite (11); Ministik Lake Area (5 samples)

	Average	Standard Deviation	Range
Quartz	32.3	± 6.2	25.4 - 37.8
Plagioclase	43.0	± 4.8	36.6 - 48.2
Potassium feldspar	22.1	± 2.6	19.2 - 24.8
Biotite	1.3	± 1.4	0 - 3.2
Hornblende	0.7	± 1.0	0 - 2.4
Magnetite	0.2	± 0.3	0 - 0.6

lated, and shows myrmekitic intergrowths. Biotite and chlorite make up 2 to 5% of the rock. Large sphene grains are common and trace amounts of epidote, muscovite and carbonate occur (Table 19).

The rock contains rafts of sheared tonalite (7), amphibolite (2b), biotite gneiss (3) and schlieren. It is cut by veins of younger monzogranite, pegmatite and aplite.

Table 16

Average Modal Composition in Volume Per Cent of Seriate to Megacrystic Granodiorite (11); Okowacheeweenik Bay Area (3 samples)

	Average	Standard Deviation	Range
Quartz	30.5	± 6.9	22.8 - 36.0
Plagioclase	39.9	± 7.6	35.2 - 48.6
Potassium feldspar	18.8	± 7.6	12.0 - 27.0
Biotite	8.9	± 4.2	4.0 - 11.8
Hornblende	2.5	± 2.1	0.4 - 4.6
Magnetite	0.3	± 0.1	0.2 - 0.4

Epidote in trace amounts

Table 17

Average Modal Composition in Volume Per Cent of Sheared Megacrystic Granodiorite (11a); Wetikoseskan Lake-Muskose Area (9 samples)

	Average	Standard Deviation	Range
Quartz	31.7	± 4.3	23.8 - 37.4
Plagioclase	43.6	± 3.9	35.8 - 49.6
Potassium feldspar	13.1	± 3.8	7.0 - 19.8
Biotite	5.1	± 4.1	0.4 - 11.1
Hornblende	6.2	± 6.8	0 - 17.6
Magnetite	0.2	± 0.2	0 - 0.6
Epidote	0.1	± 0.3	0 - 0.8

Sphene, muscovite and pyrite in trace amounts

Table 18

Average Modal Composition in Volume Per Cent of Sheared Megacrystic Granodiorite (11a); Outlaw Bay Area (8 samples)

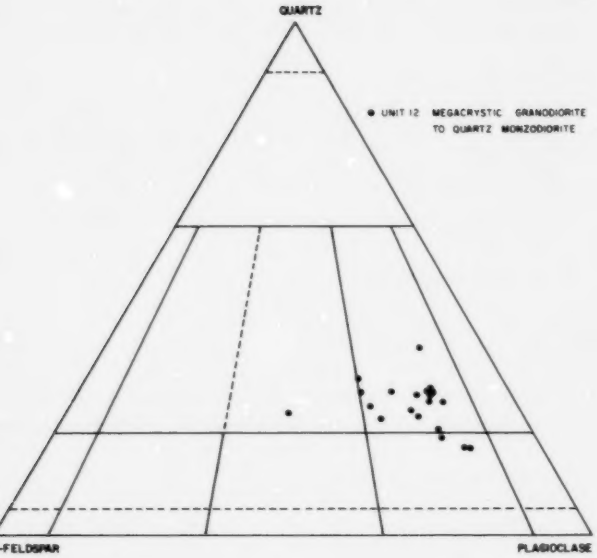
	Average	Standard Deviation	Range
Quartz	33.2	± 3.8	26.2 - 38.6
Plagioclase	46.4	± 3.4	39.8 - 50.8
Potassium feldspar	11.4	± 5.8	7.0 - 24.1
Biotite	2.7	± 3.5	0.4 - 10.0
Hornblende	5.7	± 3.7	0 - 10.6
Magnetite	0.4	± 0.4	0 - 1.0
Epidote	0.1	± 0.2	0 - 0.6

Sphene and muscovite in trace amounts

Table 19

Average Modal Composition in Volume Per Cent of Coarse Grained Granodiorite (11b); Lafontaine Lake Area (4 samples)

	Average	Standard Deviation	Range
Quartz	36.0	± 2.6	34.2 - 39.6
Plagioclase	44.2	± 5.7	38.2 - 51.4
Potassium feldspar	16.7	± 6.1	7.8 - 21.6
Biotite	2.6	± 1.9	0.2 - 4.6
Hornblende	0.4	± 0.7	0 - 1.4
Magnetite	0.3	± 0.3	trace - 0.6



igure 11:Modal compositions of megacrystic granodiorite to quartz monzodiorite (12).

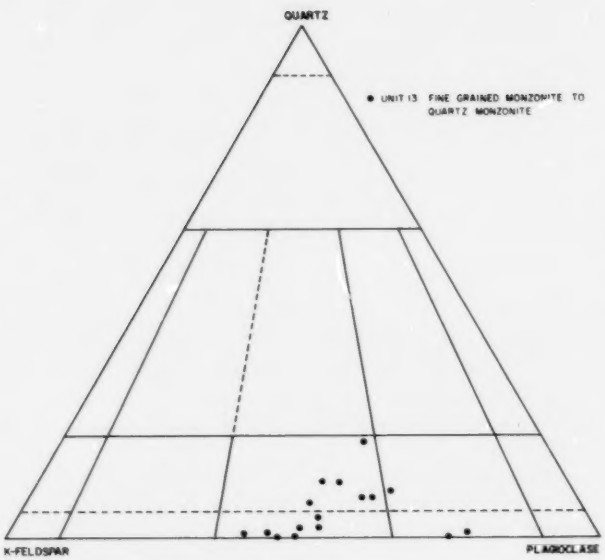


Figure 12:Modal compositions of fine grained aegirine-augite-bearing monzonite (13).

Table 20
Average Modal Composition in Volume Per Cent of Megacrystic Granodiorite (12); Pilote Lake Area (14 samples)

	Average	Standard Deviation	Range
Quartz	25.0	± 6.5	13.8 - 37.2
Plagioclase	47.0	± 7.1	35.2 - 55.4
Potassium feldspar	14.6	± 4.2	8.8 - 23.4
Biotite	5.7	± 5.7	0.2 - 14.4
Hornblende	7.2	± 5.5	0 - 16.6
Magnetite	0.2	± 0.2	0 - 0.8

Epidote, sphene, and pyrite in trace amounts

Table 21
Average Modal Composition in Volume Per Cent of Aegirine-Augite Monzonite (13); Eden Lake Area (13 samples)

	Average	Standard Deviation	Range
Quartz	4.2	± 5.4	0 - 18.2
Plagioclase	45.2	± 12.2	23.4 - 72.4
Potassium feldspar	40.0	± 8.5	24.4 - 51.6
Biotite	1.4	± 3.0	0 - 10.0
Hornblende	8.6	± 9.7	0 - 31.5
and Aegirine-augite			
Magnetite	0.5	± 0.5	0 - 1.8

Sphene, epidote and carbonate in trace amounts

MEGACRYSTIC GRANODIORITE (12)

Megacrystic granodiorite occurs in the Wetikoeeka Lake and Pilote Lake area, extending south and west to Eden Lake, south of Hughes River. Unit 12 is mottled pink, containing 2 to 3 cm porphyroblasts of perthitic microcline in a medium grained groundmass. Texture ranges from seriate to megacrystic with the feldspar megacrysts containing plagioclase remnants. The rock is massive to gneissic with some intense local shearing.

Composition ranges from granodiorite to quartz monzonite and monzogranite (Fig. 11). Unit 12 contains less quartz than megacrystic granodiorite (11), more quartz than quartz monzodiorite (5, 6a) and less potassium feldspar than megacrystic monzogranite (6). Typical samples contain 20 to 30% quartz, 35 to 40% crushed and sericitized plagioclase, and 15 to 25% perthitic feldspar. Mafic content averages 15% and consists of clots of intergrown biotite and hornblende and biotite and chlorite replacing hornblende. Magnetite, associated with pyrite and hematite, averages 0.2%. Large, well formed grains of sphene are common, as are trace amounts of epidote, allanite, diopside, carbonate and muscovite (Table 20).

Megacrystic granodiorite contains rafts of mafic volcanic rocks (1a), felsic volcanic rocks (1b), iron formation (2c), quartz diorite (6) and granodiorite (11).

Unit 12 is intruded by veins of monzogranite (17 and 18), pegmatite, and aplite. Xenoliths of unit 12 are found in units 14 and 18.

AEGIRINE-AUGITE-BEARING MONZONITE TO QUARTZ MONZONITE (13)

A body of homogeneous, equigranular, dark pink to pale purple monzonite covers an area approximately 15 km^2 east of Eden Lake. Grain size is less than 1 mm and the rock is massive with a sugary texture. Unit 13 resembles fine grained monzogranite (17) but has a much lower quartz content and contains scattered 1 mm aegirine-augite phenocrysts. At most locations quartz content is less than 4% but inclusions of unit 13 in younger monzogranites approach 10% quartz (Fig. 12). Plagioclase ranges from 30 to 50% and potassium feldspar from 30 to 50%. Mafic minerals total 10%, ranging from 0 to 10% biotite and 3 to 10% aegirine-augite and poikiloblastic hornblende. Magnetite ranges from 0.2 to 2%, epidote to 0.4% and sphene to 0.2% with traces of carbonate (Table 21).

The monzonite contains inclusions of fine grained amphibolite

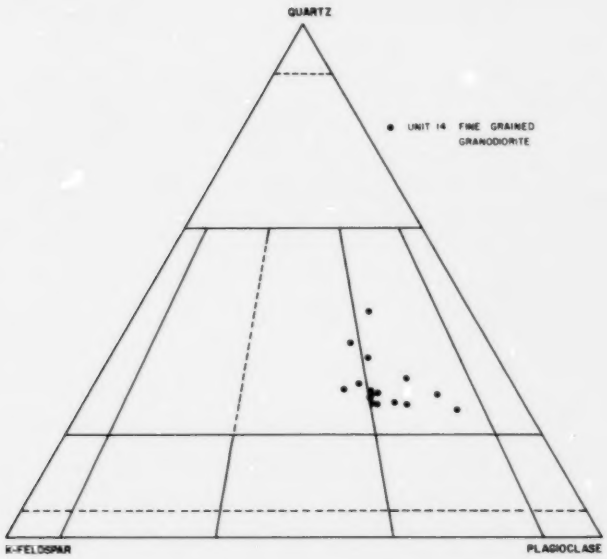


Figure 13: Modal compositions of fine grained granodiorite (14).

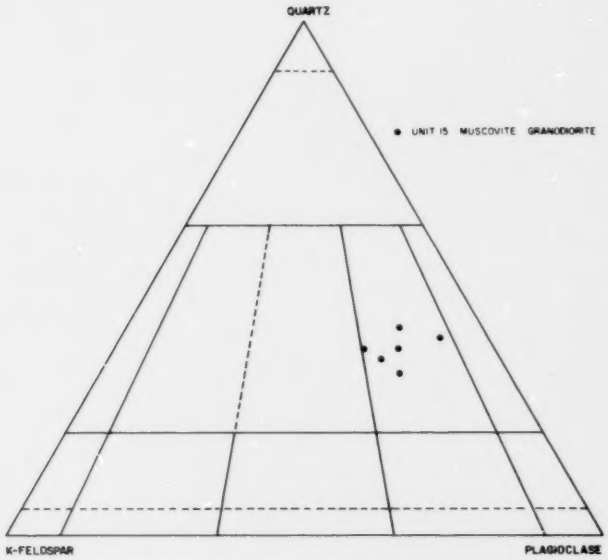


Figure 14: Modal compositions of muscovite granodiorite (15).

Table 22
Average Modal Composition in Volume Per Cent of Fine Grained Granodiorite (14); Hughes River Area (11 samples)

	Average	Standard Deviation	Range
Quartz	26.7	± 4.6	21.0 - 36.4
Plagioclase	44.2	± 6.9	37.4 - 59.6
Potassium feldspar	19.8	± 5.4	11.6 - 27.2
Biotite	4.3	± 4.6	0.6 - 17.2
Hornblende	4.7	± 5.1	0 - 9.8
Magnetite	0.3	± 0.3	0 - 1.0

Table 23
Average Modal Composition in Volume Per Cent of Muscovite Granodiorite (15); Lafontaine Lake Area (6 samples)

	Average	Standard Deviation	Range
Quartz	35.7	± 4.6	29.8 - 43.6
Plagioclase	43.6	± 5.8	33.0 - 48.8
Potassium feldspar	16.5	± 3.5	13.0 - 21.6
Biotite	2.4	± 0.6	1.6 - 3.0
Hornblende	0	± 0.1	0 - 0.2
Magnetite	0.3	± 0.2	0 - 0.6
Muscovite	1.5	± 1.6	0 - 3.6

(2b), biotite gneiss (3) and schlieren. Pegmatite dykes cutting unit 13 contain fluorite and andradite and the body is associated with a URP uranium anomaly.

FINE GRAINED GRANODIORITE (14)

Fine grained granodiorite occurs in the area around the northwestern bay of Eden Lake and along Hughes River. The rock is light grey to pink weathering, showing pink hematite staining on joint faces, and is homogeneous and massive. Grain size is 3 to 8 mm with 1.5 cm potassium feldspar porphyroblasts developed near contacts with the younger monzogranites (16 and 18). The granodiorite is similar to fine grained monzogranite (17) but contains less quartz and is slightly coarser grained (Fig. 13).

Composition ranges from 20 to 30% quartz, 35 to 55% plagioclase, 11 to 28% potassium feldspar, 1 to 15% biotite and chlorite, and 0 to 15% hornblende. Up to 1% magnetite may be present, with hematite present on magnetite-pyrite grain boundaries. Trace amounts of epidote, sphene, muscovite and diopside occur (Table 22). In xenoliths of unit 14 occurring in the younger monzogranites, plagioclase is heavily altered to sericite.

Unit 14 contains rafts of amphibolite (2b), biotite gneiss (3), quartz diorite (unit 6) and quartz monzodiorite (6a) and is cut by veins of coarse grained pink monzogranite (18), quartz, pegmatite, and white aplite. Veins of the granodiorite intrude units 6, 6a, and 12 in the north-central part of the area.

MUSCOVITE GRANODIORITE (15)

White to light pink weathering muscovite-bearing granodiorite (Fig. 14) intrudes unit 11b near the western boundary of the area. Unit 15 is medium- to coarse-grained, massive, homogeneous and equigranular. Due to its isolation from other phases, field relations of the muscovite granodiorite remain unclear. The rock is notably free of inclusions, containing only rare schlieren and nebulitic tonalite xenoliths. Quartz veins are the only younger phase present.

The granodiorite contains 35 to 40% quartz, 45 to 50% plagioclase, 13 to 20% potassium feldspar, up to 3% biotite, less than 3% biotite, 3% muscovite and up to 0.4% magnetite. Sillimanite, hematite, hornblende and metamict epidote and allanite occur in trace amounts. Plagioclase is crushed and recrystallized with heavily altered cores in all larger phenocrysts, and myrmekite is present (Table 23). Potassium feldspar contains remnant plagioclase and corrodes plagioclase grain boundaries.

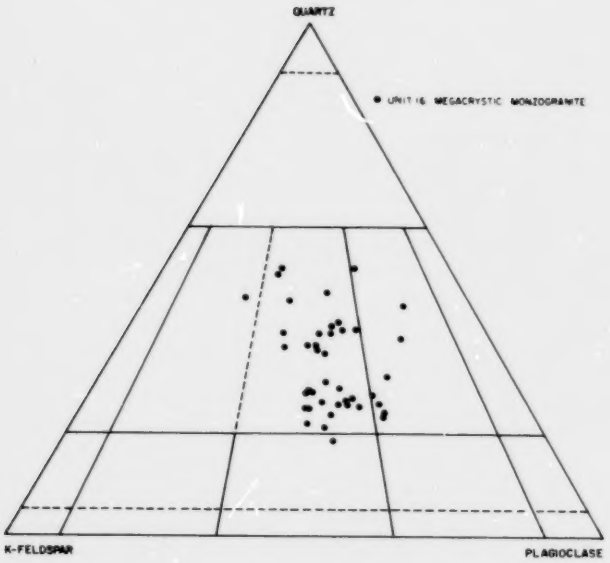


Figure 15: Modal compositions of megacrystic monzogranite (16).

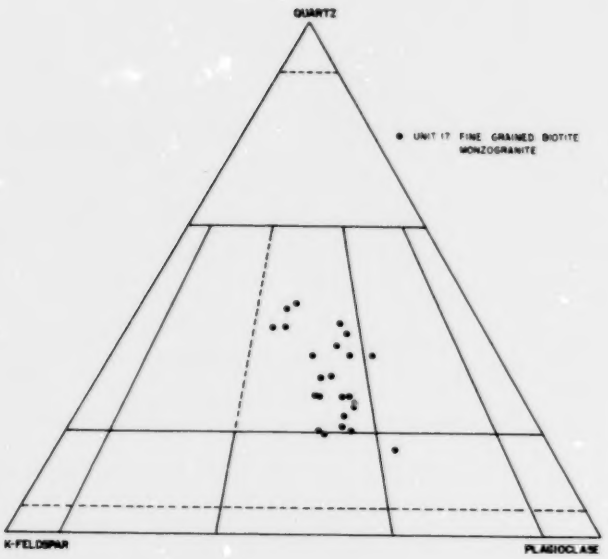


Figure 16: Modal compositions of fine grained monzogranite(17).

Table 24
Average Modal Composition in Volume Per Cent of Megacrystic Monzogranite (16); Eden Lake Area (29 samples)

	Average	Standard Deviation	Range
Quartz	24.4	± 5.1	17.2 - 38.2
Plagioclase	37.8	± 5.0	30.2 - 48.4
Potassium feldspar	28.7	± 4.1	21.2 - 35.6
Biotite	5.4	± 4.2	0 - 15.4
Hornblende	3.0	± 3.4	0 - 11.6
Magnetite	0.4	± 0.5	0 - 1.7

Epidote, sphene and pyrite in trace amounts

Table 25
Average Modal Composition in Volume Per Cent of Megacrystic Monzogranite (16); Subordinate Quartz-Rich Phase; Muskose Bay Area (5 samples)

	Average	Standard Deviation	Range
Quartz	45.6	± 3.6	41.2 - 50.8
Plagioclase	20.1	± 4.5	15.6 - 27.0
Potassium Feldspar	28.0	± 5.4	21.6 - 36.6
Biotite	4.8	± 4.1	0 - 9.0
Hornblende	0.8	± 0.9	0 - 2.0
Magnetite	0.5	± 0.5	0 - 1.4

Sphene and pyrite in trace amounts

Monzogranite Suite

MEGACRYSTIC MONZOGRANITE (16)

Megacrystic monzogranite is associated with fine grained (17) and coarse grained (18) granitic phases in the northeast. Unit 16 is characterized by 2 to 4 cm subhedral to lenticular microcline megacrysts in a fine- to medium-grained granitic groundmass. The megacrysts are the result of late potassium metasomatism and commonly contain remnant plagioclase. In the north quartz grains are shattered and the interstitial material has been granulated. This may be due to the proximity of an eastward extension of the Johnson Shear zone along Barrington River.

Composition of the monzogranite is 20% quartz, 30 to 40% perthitic microcline and 30 to 40% plagioclase (Fig. 15). Plagioclase phenocrysts have heavily sericitized cores and myrmekitic intergrowths are common. Mafic minerals total approximately 8%, usually as biotite, although green poikiloblastic hornblende and chlorite also occur. Magnetite and associated pyrite and hematite ranges from 0.2 to 2%. Other accessory minerals include large euhedral sphene, epidote, allanite, and carbonate (Table 24). A related phase, containing in excess of 40% quartz, occurs within unit 16 west of Muskose Bay, but it could not be separated as a mappable subunit (Table 25).

In the northeast corner of the area the megacrystic granite surrounds the body of fine grained granite (17), with grain size decreasing toward the contact. Plagioclase content increases near the eastern boundary of the map area and composition approaches granodiorite.

Veins of fine grained monzogranite, coarse grained monzogranite (unit 18), pegmatite and graphic granite intrude unit 16. The megacrystic granite contains inclusions of hornblende-bearing arkosic gneiss, grey biotite gneiss and amphibolite.

The granite intrudes the granodiorite suite between Pilote Lake and Muskose Bay. There unit 16 contains inclusions of tonalite (7) megacrystic granodiorite (11 and 12), fine grained granodiorite (14) and biotite gneiss (3).

Unit 16 is similar in appearance to megacrystic quartz monzodiorite (6a) but is more potassic and contains fewer mafic minerals. It can be distinguished from the megacrystic granodiorites by higher quartz and potassium feldspar contents and lower percentage of plagioclase.

A preliminary U-Pb zircon age of 1844 ± 10 Ma has been obtained by Van Schmus (pers. comm., 1987) for a sample of the

Table 26
Average Modal Composition in Volume Per Cent of Fine Grained Monzogranite (17); Eden Lake Area (21 samples)

	Average	Standard Deviation	Range
Quartz	30.4	± 8.4	16.4 - 44.0
Plagioclase	37.1	± 8.5	23.2 - 56.0
Potassium feldspar	27.6	± 5.1	14.0 - 37.0
Biotite	1.5	± 2.0	0 - 7.0
Hornblende	1.8	± 3.0	0 - 10.8
Magnetite	0.5	± 0.5	0 - 1.6

Sphene and hematite in trace amounts

megacrystic granite taken on Provincial Road 391 near the eastern boundary of the map area.

FINE GRAINED BIOTITE MONZOGRANITE (17)

Fine grained, massive, homogeneous pink monzogranite forms the core of the granite body which underlies the northeast corner of the map area. Grain size is 1 to 2 mm with some microcline phenocrysts to 4 mm. A weakly porphyritic phase (17a) contains microcline phenocrysts in the 4 to 5 mm range, with some as large as 1 cm. Unit 17 is similar in appearance to fine grained monzonite (13) but contains significantly more quartz and lacks aegirine-augite (Fig. 16). The rock comprises 20 to 30% quartz, 30 to 50% plagioclase and 30% potassium feldspar, with less than 7% total mafic minerals (as biotite with minor chlorite). Magnetite is generally less than 2% and is usually associated with sphene and hematite (Table 26). Epidote, allanite, diopside, garnet, apatite, and muscovite occur in trace amounts. Plagioclase is generally well preserved but shows some development of sericite, saussurite and myrmekite. Plagioclase grain boundaries are corroded by potassium feldspar.

The monzogranite is intruded by pegmatite, aplite, and red graphic granite and contains inclusions of biotite gneiss and megacrystic granite.

COARSE GRAINED MONZOGRANITE (18)

Coarse grained monzogranite occurs along the Hughes River channel in the north and on the south shore of Eden lake. The granite is pink, homogeneous, and massive to weakly foliated, with local shearing near the contact with unit 6a. Average grain size is 4 mm with some microcline and pale green plagioclase to 1 cm. Quartz is elongated in the foliation direction. Rare microcline megacrysts as large as 3 cm occur.

Composition is similar to that of units 16 and 17 (Fig. 17), having a well defined symmetrical distribution centred on the monzogranite field shifting towards granodiorite where it contains rafts of quartz monzodiorite. The average quartz content is 28%; plagioclase, 38%; microcline, 27%; biotite, 6%; hornblende, 1% and magnetite, 0.3%. Sphene, epidote, allanite, hematite, apatite, carbonate and leucoxene are present in trace amounts (Table 27). Plagioclase phenocrysts are zoned and have sericitized cores. Perthitic microcline corrodes the plagioclase.

Unit 18 contains inclusions of units 2 and 3 and larger rafts of units 6 and 6a.

PEGMATITE, GRAPHIC GRANITE, AND APLITE (19)

Pegmatite, pegmatitic granite, graphic granite, and aplite occur most commonly in the eastern half of the map area, associated with the granitic intrusive rocks in the northeast and in biotite tonalite and granodiorite (7 and 8) near contacts with younger granites and

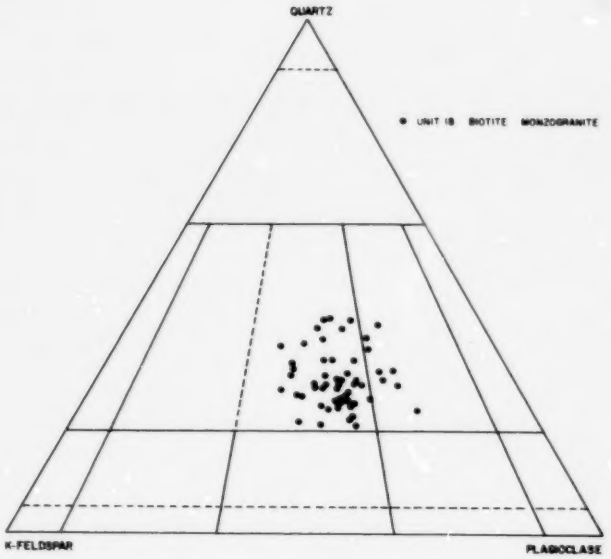


Figure 17:Modal compositions of coarse grained monzogranite (18).

Table 27
Average Modal Composition in Volume Per Cent of Coarse Grained Monzogranite (18); Hughes River and Southern Eden Lake Area (39 samples)

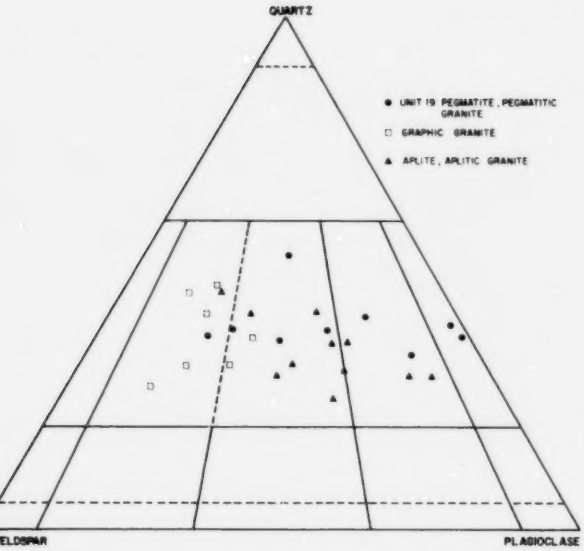
Average	Deviation	Standard Range	
Quartz	28.8	± 6.4	20.6 - 53.0
Plagioclase	35.8	± 6.2	14.3 - 46.2
Potassium feldspar	28.6	± 4.8	18.4 - 37.0
Biotite	4.5	± 3.9	0 - 12.4
Hornblende	1.9	± 3.9	0 - 23.0
Magnetite	0.4	± 0.4	0 - 1.6

Sphene and epidote in trace amounts in the southwest

granodiorites (Fig. 6). Veins and dykes range from a few centimetres to over 100 m thick.

The pegmatite and pegmatitic granite have a simple mineralogy comprising 40 to 50% blocky, brick red microcline, 20% cream plagioclase, 30% dark grey quartz, and up to 2% biotite and hornblende with magnetite, sphene and allanite as accessory minerals (Fig. 18). In the Outlaw Bay-Okawacheeweenik Bay area the pegmatites are sheared, showing complete crushing and recrystallization of feldspars to sericite and saussurite. These dykes also contain minor amounts of muscovite, garnet, pyrite, hematite and allanite.

Graphic granite is coarse grained, pink to brick-red and ranges in composition from monzogranite to syenogranite. It contains 30 to 40% quartz, 25 to 40% microcline and perthite, and 30% plagioclase, with up to 1% biotite and chlorite, 1% hornblende and 1% magnetite and hematite. Sphene and apatite also occur. Plagioclase shows dusty alteration, myrmekitic intergrowths and saussuritization. The



gure 18: Modal compositions of pegmatitic and aplitic granites (19).

graphic granite, which forms high bare hills and ridges surrounded by lower ground underlain by granodiorite (8). The granite contains xenoliths of the granodiorite, tonalite and biotite gneiss and is intruded by dykes and veins of younger pegmatite.

Aplite and aplitic granite are fine grained, sugary, white to pink and occurs as veins in units 6, 7 and 8. Composition ranges from monzogranite to granodiorite and tonalite.

ECONOMIC GEOLOGY

Little mineral exploration has been carried out in the Eden Lake area. Cancelled assessment files contain nine reports for the years 1954 to 1977; seven deal with regional airborne geophysical surveys, one with ground geophysics and one with diamond drilling. The results of the surveys have been compiled and summarized by Hosain (1981). At present there are no active claims in the area.

Airborne EM and magnetometer surveys show medium to weak conductors which appear to be related to structural trends over lakes. In 1970 Barringer Research carried out ground magnetometer and VLEM surveys at the junction of Outlaw Bay and Okowacheeweenik Bay which show several weak conductors following the strong northeast trend of Outlaw Bay.

Several medium to strong EM anomalies along the contact between tonalite (7) and the monzogranites (16 and 17) north of Outlaw Bay were covered by the Jit claims (Hudson Bay Exploration and Development) in 1971. Nine diamond drill holes totalling 694 m were targetted on the anomalies. Most show intersections of pyrite, pyrrhotite, and graphite.

Sulphide occurrences are rare in the Eden Lake area. Trace amounts of pyrite are found in the intrusive rocks as replacements for magnetite. Disseminated pyrite and pyrrhotite were noted in some exposures of metavolcanic rocks in the Outlaw Bay area and south of Pilote Lake. Two outcrops of layered iron formation were noted south of Pilote Lake.

In 1977 the area was covered by an airborne gamma ray spectrometer survey as part of the Federal Provincial Uranium Reconnaisance Program (URP). The resulting maps show anomalies for potassium, equivalent uranium and equivalent thorium in the northeast quadrant of the map sheet over the monzogranites (16 and 17) and the aegirine-augite-bearing monzonite (13). These anomalies may be related in part to the late potassium metasomatism in that part of the map area. Fluorite- and andradite-bearing pegmatite dykes occur within the aegirine-augite-bearing monzonite.

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